The University of Portland
Donald P. Shiley School of Engineering

EE352
Electronic Circuits II
HOMEWORK 2

Assigned: Fri, Jan 24, 2020
Due: Mon, Feb 3, 2020

Problems:

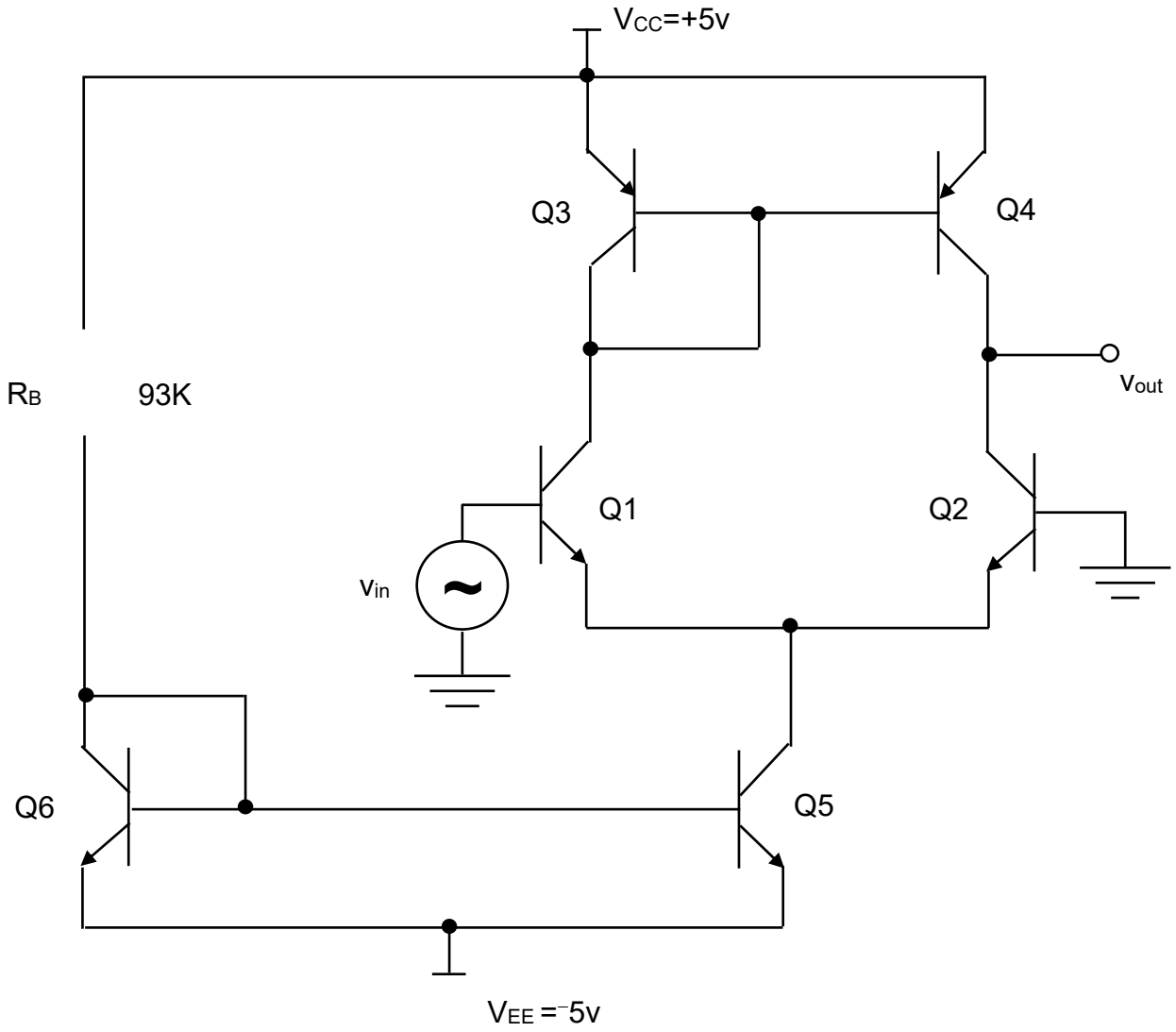
1. For the active-loaded BJT Differential Amplifier on the next page, assume the BJT's are matched and have the following model parameters: β_n=150, β_p=100, V_{An}=130V, V_{Ap}=80V, V_T=25mV, and $V_{BE\text{-}on}$=0.7V (for all BJT's).

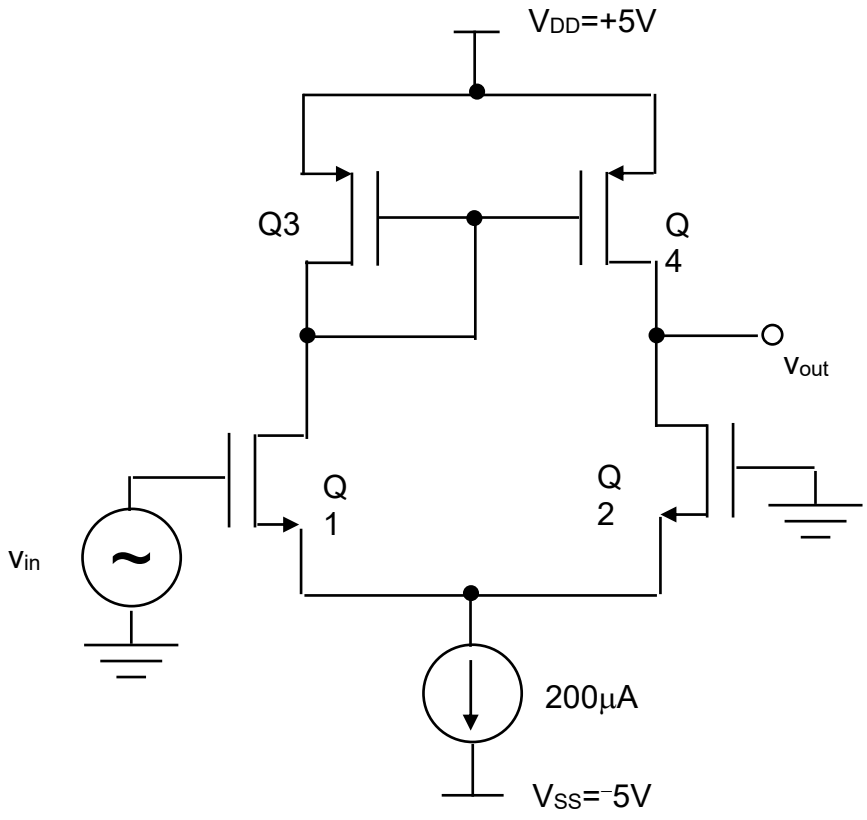
   a) Determine the DC node voltages (except the output node voltage) and branch currents using hand calculations. (Note, you may make reasonable approximations which simplifies things greatly).

   b) Determine the small-signal AC parameters A_d (=A_{do}, since there is no R_L), R_{id} and R_{od} using hand calculations. (Note, there is no common mode to worry about since this is the active-load configuration. So you don't need to calculate A_{cm} (=A_{cmo}), R_{icm} and R_{ocm}).

   c) In PSPICE, use Transfer Function Analysis with Bias Points Details turned on to verify your DC and AC hand-calculated values above. Remember to edit the BJT transistor models properly by setting BF and VAF. (Note that you cannot set $V_{BE\text{-}on}$ in PSPICE). Remember to look at your xxx.out file for your answers. As usual, please turn in printouts of your *properly annotated* PSPICE schematic and *properly edit'ed and annotated* xxx.out file.

2. Repeat Problem 1 for the active-loaded MOS Differential Amplifier shown on reverse page. Assume the MOSFET's are matched and have the following model parameters: V_{tn}=1V, K_n=250μA/V^2, λ_n=.02, V_{tp}=−1.5V, K_p=200μA/V^2, λ_p=.05. In PSPICE, use Mbreakn3 and Mbreakp3 and edit their models properly by setting LAMBDA and VTO and, specifically, KP=500U for the nFET and KP=400U for the pFET.


V_{CC}=+5v
Q3
Q4
R_B
93K
v_{out}
Q1
Q2
v_{in}
Q6
Q5
V_{EE} =−5v


V_{DD}=+5V
Q3
Q 4
v_{out}
Q 1
Q 2
v_{in}
200μA
V_{SS}=−5V